(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
8 April 2004 (08.04.2004)

PCT

(10) International Publication Number
WO 2004/029690 A1

BEST AVAILABLE COPY

(51) International Patent Classification[7]: G02B 21/00, G01N 33/487

(21) International Application Number: PCT/PH2002/000018

(22) International Filing Date: 27 September 2002 (27.09.2002)

(25) Filing Language: English

(26) Publication Language: English

(71) Applicants and

(72) Inventors: **SALOMA, Caesar, A.** [PH/PH]; National Institute of Physics, College of Science, University of the Philippines, Diliman, Quezon City 1101 (PH). **PALERO, Jonathan, A.** [PH/PH]; National Institute of Physics, College of Science, University of the Philippines, Diliman, Quezon City 1101 (PH). **GARCIA, Wilson, O.** [PH/PH]; National Institute of Physics, College of Science, University of the Philippines, Diliman, Quezon City 1101 (PH).

(74) Agent: **VILLARAZA & ANGANGCO LAW OFFICES AND ITS ATTORNEYS**; 5th Floor, LTA Building, 118 Perea Street, Legaspi Village, 1229 Makati City (PH).

(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZM, ZW.

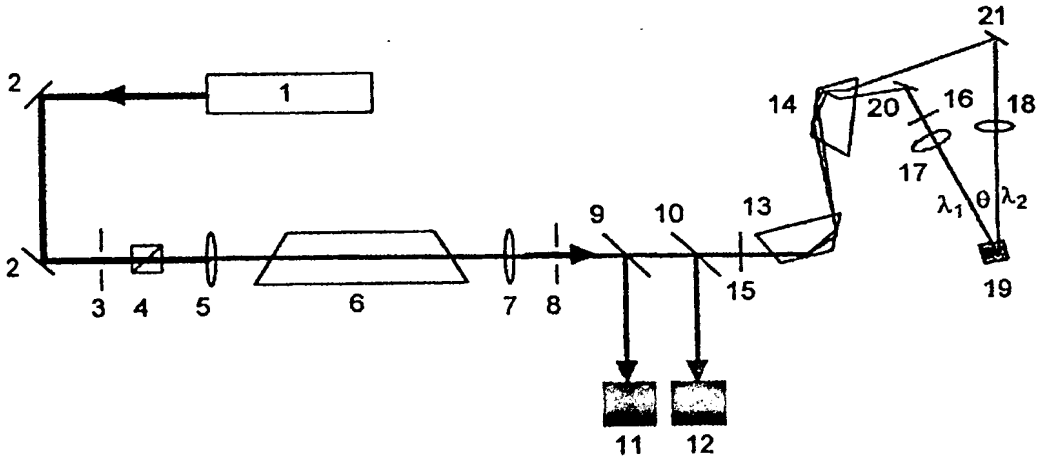
(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:
— *of inventorship (Rule 4.17(iv)) for US only*
— *of inventorship (Rule 4.17(iv)) for US only*

Published:
— *with international search report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: TWO-COLOR (TWO-PHOTON) EXCITATION WITH FOCUSED EXCITATION BEAMS AND A RAMAN SHIFTER



(57) Abstract: Two-color (two-photon) excitation with two confocal excitation beams is demonstrated with a Raman shifter as excitation light source. Two-color excitation fluorescence is obtained from Coumarin 6H dye sample (peak absorption = 394 nm, peak fluorescence = 490 nm) that is excited using the first two Stokes outputs (683 nm, 954 nm, two-color excitation = 398 nm) of a Raman shifter pumped by a 6.5 nsec pulsed 532 nm-Nd:YAG laser (Repetition rate = 10 Hz). The two Stokes pulses overlap for a few nanoseconds and two-color fluorescence is generateven with focusing objectives of low numerical apertures (NA ≤ 0.4). We observed the linear dependence of the two-color fluorescence signal with the product of the average intensities of the two Stokes excitation beams. The two-color fluorescence distribution is strongly localized around the common focus of the confocal excitation beams.

WO 2004/029690 A1

INTERNATIONAL SEARCH REPORT

Int[redacted] Application No
PCT/PH 02/00018

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G02B21/00 G01N33/487

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 G02B G01N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DYER M J ET AL: "LASER-INDUCED FLUORESCENCE MEASUREMENT OF OXYGEN ATOMS ABOVE A CATALYTIC COMBUSTOR SURFACE" APPLIED OPTICS, OPTICAL SOCIETY OF AMERICA,WASHINGTON, US, vol. 29, no. 1, 1990, pages 111-118, XP000086683 ISSN: 0003-6935 page 112-113; figures 1,2 --- -/--	1-24

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
5 March 2003	17/03/2003

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Mason, W

Form PCT/ISA/210 (second sheet) (July 1992)

BEST AVAILABLE COPY

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
X	MURAOKA K ET AL: "Diagnostics for the spatial distribution of hydrogen atoms around the divertor region" 11TH INTERNATIONAL CONFERENCE ON PLASMA-SURFACE INTERACTIONS IN CONTROLLED FUSION DEVICES, MITO, JAPAN, 23-27 MAY 1994, vol. 220-222, pages 563-566, XP002233480 Journal of Nuclear Materials, April 1995, Netherlands ISSN: 0022-3115 page 563-565; figure 3 ---	1-24
X	HOLTOM G R ET AL: "The application of nonlinear raman spectroscopy to provide molecular specificity in 3-D biological imaging" CONFERENCE ON LASERS AND ELECTRO-OPTICS. (CLEO 2001). TECHNICAL DIGEST. POSTCONFERENCE EDITION. BALTIMORE, MD, MAY 6-11, 2001, TRENDS IN OPTICS AND PHOTONICS. (TOPS), US, WASHINGTON, WA: OSA, US, vol. 56, 6 May 2001 (2001-05-06), pages 362-363, XP010559945 ISBN: 1-55752-662-1 abstract ---	1-24
X	US 5 995 281 A (SIMON ULRICH ET AL) 30 November 1999 (1999-11-30) column 1-4; figures 1,2,9 ---	1-24
X	US 5 891 738 A (SOINI ERKKI ET AL) 6 April 1999 (1999-04-06) column 6-7; figures 1,6,7 column 9-10 column 13-16 ---	1-24
X	FLETCHER D G: "TWO-PHOTON EXCITATION OF ATOMIC OXYGEN USING A RAMAN-SHIFTED ARF-EXCIMER LASER" APPLIED PHYSICS B: LASERS AND OPTICS, SPRINGER INTERNATIONAL, BERLIN, DE, vol. B60, no. 1, 1995, pages 61-65, XP000489187 ISSN: 0946-2171 page 62-63; figure 5 ---	1-24
X	US 2002/109841 A1 (GOULD GENE ET AL) 15 August 2002 (2002-08-15) page 7-10; figures 2A,,3 ---	1-24
X	US 5 192 980 A (DIXON ARTHUR E ET AL) 9 March 1993 (1993-03-09) column 4-6; figures 3-5 ---	1-24

-/--

BEST AVAILABLE COPY

INTERNATIONAL SEARCH REPORT

International Application No
PCT/PH 02/00018

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6 448 088 B1 (WARDLAW STEPHEN C ET AL) 10 September 2002 (2002-09-10) column 3; figure 8 column 7	1-24
X	US 5 887 009 A (GARRETT MARK H ET AL) 23 March 1999 (1999-03-23) column 7-9; claim 32; figures 1,2	1-24

BEST AVAILABLE COPY

INTERNATIONAL SEARCH REPORT

Int[illegible] Application No
PCT/PH 02/00018

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
US 5995281	A	30-11-1999	DE	19744302 A1	15-04-1999
US 5891738	A	06-04-1999	FI	96641 B	15-04-1996
			FI	951040 A	08-09-1996
			DE	69615818 D1	15-11-2001
			DE	69615818 T2	06-06-2002
			EP	0804732 A1	05-11-1997
			WO	9622531 A1	25-07-1996
			JP	3215428 B2	09-10-2001
			JP	10512670 T	02-12-1998
			EP	0815447 A1	07-01-1998
			WO	9627798 A1	12-09-1996
			JP	11503824 T	30-03-1999
			US	6204068 B1	20-03-2001
US 2002109841	A1	15-08-2002	WO	02059584 A2	01-08-2002
US 5192980	A	09-03-1993	NONE		
US 6448088	B1	10-09-2002	US	6004821 A	21-12-1999
			AU	747604 B2	16-05-2002
			AU	2768899 A	20-09-1999
			CA	2322946 A1	10-09-1999
			CN	1292873 T	25-04-2001
			EP	1070250 A1	24-01-2001
			NO	20004452 A	03-11-2000
			WO	9945382 A1	10-09-1999
US 5887009	A	23-03-1999	WO	9853272 A1	26-11-1998

BEST AVAILABLE COPY